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HEAD CABLE FOR PRINTING DEVICE  
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[What is Claimed is]

1. A head cable for a printing device, characterized in that one end side thereof is connected to a print head mounted on a carriage arranged in a reciprocating manner and the other end side is connected to a printing device body side, said head cable for a printing device comprising a plurality of flat cables which have been stacked, wherein the lengths of deformably-arranged portions of the plurality of flat cables comprising the head cable for a printing device are configured to be successively shorter towards the inside.

[Brief Explanation of the Drawings]

FIG. 1 is a drawing of an embodiment of the present invention and shows the structure of a head cable for a printing device as well as the periphery thereof.

FIG. 2 is a drawing of a conventional example and shows the structure of a head cable for a printing device as well as the periphery thereof.

FIG. 3 is a drawing of a conventional example and shows the structure of a head cable for a printing device as well as the periphery thereof.

FIG. 4 is a drawing of a conventional example and shows the structure of a head cable for a printing device as well as the periphery thereof.



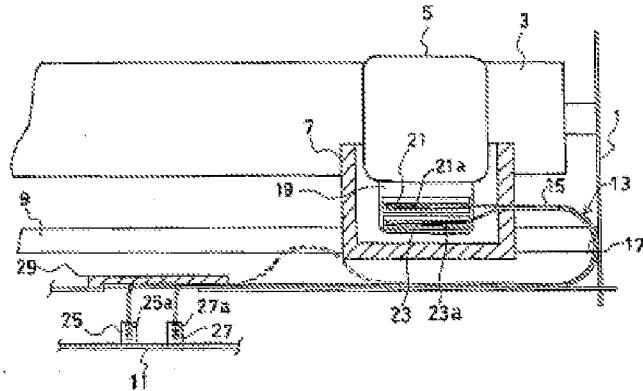
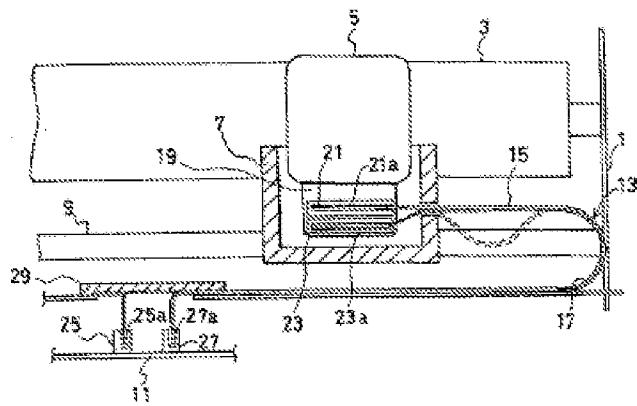


Figure 4



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[Detailed Explanation of the Invention]

[0001]

[Field of Industrial Application]

The present invention relates to, for example, a head cable for a printing device connecting a print head mounted with a printing device carriage to a main PCB (print circuit board) fixed onto the printing device body side and, more specifically, relates to a configuration in which it is possible to prevent the bending and bulging of a plurality of thin plate-like flat cables arranged on the inner side of a carriage in a stacked state accompanying the movement of the carriage.

[0002]

[Prior Art]

In the prior art, printing device carriages and the peripheries thereof are generally comprised as is shown in FIG. 2. First, a platen 3 is rotatably mounted within a frame body 1 corresponding to a printing device. A print head 5 is then arranged in a position opposed to platen 3, and this print head 5 is mounted on a carriage 7. This carriage 7 is comprised to reciprocate in the right-to-left direction in the figure along a carriage stay 9 arranged within frame body 1. Print head 5 is also made to reciprocate in the same direction in the figure accompanying the reciprocation of carriage 7.

[0003]

Meanwhile, a main PCB 11 is fixed onto frame body 1 and this main PCB 11 is electrically connected with the aforementioned print head 5 via a printing device head cable 13. The aforementioned printing device head cable 13 is comprised of a thin plate-like outer flat cable 15 and inner flat cable 17 which are stacked upon one another. Printing device head cable 13 and print head 5 are connected according to the following structure. First, a portion of a substrate 19, installed with connectors 21 and 23, is arranged such as to protrude from the print head 5 side. Insertion ports 21a and 23a are formed onto connectors 21 and 23, into which is inserted the end portions of outer flat cable 15 and inner flat cable 17 of printing device head cable 13 together with a reinforcing plate not shown in the figures, thereby electrically connecting printing device head cable 13 to print head 5.

[0004] Additionally, the connection structure of printing device head cable 13 and the main PCB 11 side is configured as follows.

Connectors 25 and 27 are installed onto the main PCB 11 side, and the end portions of outer flat cable 15 and inner flat cable 17 of printing device head cable 13 are inserted into connection ports 25a and 27a corresponding to connectors 25 and 27 together with a reinforcing plate not shown in the figures, thereby electrically connecting printing device head cable 13 to the main PCB 11 side.

Furthermore, outer flat cable 15 and inner flat cable 17 on the main PCB 11 side are pressed onto a frame body 1 by means of a cable presser plate 29. Moreover, the length of the deformable portion of outer flat cable 15 corresponding to printing device head cable 13 (the length from the outer surface of carriage 7 to the edge surface of presser plate 29;  $L_A$ ) and the length of the deformable portion of inner flat cable 17 (the length from the outer surface of carriage 7 to the edge surface of presser plate 29;  $L_B$ ) are set at approximately equal values.

[0005]

[Problem to be Solved by the Invention]

With the aforementioned conventional structure, however, the following problems tend to arise. As explained above, the length of the deformable portion of outer flat cable ( $L_A$ ) and the length of the deformable portion of inner flat cable 17 ( $L_B$ ) are set at approximately equal values. This presents no major problem when the cables are implanted according to design and installed at

approximately equal lengths, but when the relationship between the length of flat cable 15 ( $L_A$ ) and the length of flat cable 17 ( $L_B$ ) is expressed in the following formula (I), inner flat cable 17 will bend and bulge as demonstrated by the broken line in FIG. 2. In other words, inner flat cable 17 cannot escape to the outside, thus causing it to bulge internally.

$$L_A < L_B \text{ ---- (I)}$$

If inner flat cable 17 bends and bulges in this way, then, it will collide with carriage 7 and impede the reciprocating action of carriage 7, and, at the same time, inner flat cable 17 will damage carriage 7 with such a collision.

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[0006] The case in which inner flat cable 17 bends and bulges is demonstrated not only in FIG. 2, but also in FIG. 3 and FIG. 4. FIG. 3 demonstrates a case in which carriage 7 moves to the right side of the figure and then moves back to the left side of the figure, thereby causing inner flat cable 17 to bend and bulge when moving into this left side position. In this case, further movement of carriage 7 is inhibited and inner flat cable 17 may potentially be damaged. Moreover, FIG. 4 demonstrates a case in which inner flat cable 17 bends and bulges when carriage 7 attempts to move toward the aforementioned right side position. In this case, further movement of carriage 7 is inhibited and inner flat cable 17 may potentially be damaged.

[0007] Additionally, with the aforementioned conventional structure, when outer flat cable 15 and inner flat cable 17 are approximately

the same length, both cables become positioned together on the same route, thus causing the contact surfaces between outer flat cable 15 and inner flat cable 17 to be strongly press-contacted against each other and, in effect, allowing both of these surfaces to stick to one another. When carriage 7 moves under these circumstances, then, the portion inverted and bent by outer flat cable 15 and inner flat cable 17 (hereafter, "inverted and bent portion") attempts to move in accompaniment with the motion of carriage 7, but, because outer flat cable 15 and inner flat cable 17 are stuck together, outer flat cable 15 and inner flat cable 17 become tight, thus hindering the smooth movement of the inverted and bent portion and, in turn, causing the movement of carriage 7 to become unstable, and, further, causing the inverted and bent portion to be forcefully moved in a pressure-contact state, thereby forcing outer flat cable 15 and inner flat cable 17 to strongly rub against one another, ultimately damaging the covering portion corresponding to outer flat cable 15 and inner flat cable 17.

[0008] The object of the present invention, which was developed in response to such problems in the prior art, is to provide a head cable for a printing device ensuring smooth reciprocation of its carriage and preventing damage to the flat cable itself by eliminating a phenomenon in which the internally-arranged flat cable bends and bulges.

[0009]

[Means of Solving the Problem]

In order to fulfill the above-cited object, the inventive head cable for a printing device is characterized in that one end side thereof is connected to a print head mounted on a carriage arranged in a reciprocating manner and the other end side is connected to a printing device body side, said head cable for a printing device comprising a plurality of flat cables which have been stacked, wherein the lengths of deformably-arranged portions of the plurality of flat cables comprising the head cable for a printing device are configured to be successively shorter towards the inside.

[0010]

[Action]

The present invention configures a plurality of flat cables constituting a head cable for a printing device such that they are successively shorter towards the inside. Doing so prevents bending and bulging of the internally-arranged cable upon reciprocation of the carriage. The flat cable can thus be used without incurring damage.

[0011]

[Embodiments]

An embodiment of the present invention is hereafter explained in reference to FIG. 1. When possible, the numerals corresponding to the prior art have been maintained for identical components in the present embodiment and FIG. 1. In the case of the present embodiment, the relationship between the length of a deformable portion of outer

flat cable 15 corresponding to a printing device head cable 13 (the length from the outer surface of a carriage 7 to the edge surface of a presser plate 29;  $L_A$ ) and the length of a deformable portion of an inner flat cable 17 (the length from the outer surface of carriage 7 to the edge surface of presser plate 29;  $L_B$ ) is set as expressed in the following formula (II).

$$L_A > L_B \text{ ---- (II)}$$

More concretely, the length of the space between outer flat cable 15 and inner flat cable 17 must, at the very least, be a value at which the relationship expressed by Formula II will not be disestablished by dimensional variation. In the present embodiment of the invention, this value is suitably set between 2 - 10 mm. Other structures in this embodiment remain the same as those in the prior art, and are therefore not repetitively explained herein.

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[0012] The following actions and effects can be actualized through the above-described structure. First, the relationship between the length of the deformable portion of outer flat cable 15 corresponding to printing device head cable 13 ( $L_A$ ) and the length of the deformable portion of inner flat cable 17 ( $L_B$ ) is set as expressed in the aforementioned Formula (II) such that the length of the deformable portion of outer flat cable 15 ( $L_A$ ) is longer than the length of the deformable portion of outer flat cable 17 ( $L_B$ ). Doing so prevents bending and bulging of inner flat cable 17 upon reciprocation of carriage 7. This, in turn, ensures the smooth reciprocation of carriage 7 and prevents damage to inner flat cable

17 resulting from collision with carriage 7. At the same time, a slight gap is formed between outer flat cable 15 and inner flat cable 17, thereby preventing outer flat cable 15 and inner flat cable 17 from sticking together at the inverted and bent portions thereof, thus avoiding damage caused by forceful rubbing between outer flat cable 15 and inner flat cable 17 and additionally avoiding unstable movement of carriage 7.

[0013] It should further be noted that the present invention is not necessarily limited to the above-described embodiment. The aforementioned embodiment discloses a head cable for a printing device constituted by a flat cable comprising two cables total (outer flat cable 15 and inner flat cable 17), but a head cable for a printing device constituted by 3 or more stacked cables may also be applied in the same fashion described above. In this case, the lengths of the internally-arranged flat cables must be successively shorter by a specified amount. Furthermore, it is not necessary for the width of each flat cable to be identical, and a head cable for a printing device comprised of stacked flat cables with differing widths may also be applied in the same fashion described above.

[0014]

#### [Effects of the Invention]

With the above-described head cable for a printing device of the present invention, the lengths of a plurality of flat cables comprising a head cable for a printing device are configured to be successively shorter towards the inside. 8/ Doing so prevents bending and bulging of an internally-arranged flat cable upon reciprocation a

carriage. This, in turn, ensures the smooth reciprocation of the carriage and prevents damage to the bulging inner flat cable resulting from collision with carriage 7. Thus, damage to the flat cable can be prevented and the service life thereof can be extended.